

2006-06-01

Associated Electric Co., Inc.

P.O. Box 100, Springfield, MO 65801-0100

New England Power Plant

St. James Road, Boston, MA 02136

St. James Road, Boston, MA 02136

Installation of Fire-Fire (OFA), combustion controls on Units 1 and 2. This
review was completed in accordance with Section (8), Missouri State Rule
10 CSR 10-6.00. *Permits Required.*

Page No.	2
Permit No.	
Project No.	2006-06-026

SPECIAL CONDITIONS:

The permittee is authorized to construct and operate subject to the following special conditions:

The special conditions listed in this permit were included based on the authority granted the Missouri Air Pollution Control Program by the Missouri Air Conservation Law (specifically 643.075) and by the Missouri Rules listed in Title 10, Division 10 of the Code of State Regulations (specifically 10 CSR 10-6.060). For specific details regarding conditions, see 10 CSR 10-6.060 paragraph (12)(A)10. "Conditions required by permitting authority."

New Madrid Power Plant
New Madrid County, S22N, T29, R14E

1. Standards of Performance for Best Available Control Technology (BACT) for Carbon Monoxide (CO)
 - A. New Madrid Power Plant shall not emit more than 0.55 pounds of CO per million British Thermal Units (lb/MMBTU) of heat input each from Unit 1 and Unit 2 based on a 30-day rolling average. This limit is exclusive of emissions occurring during start-up, shutdown and malfunction.
 - B. New Madrid Power Plant shall not emit more than 34,449 tons per year of CO combined from Unit 1 and Unit 2. This limit is inclusive of emissions during start-up, shutdown and malfunction.
 - C. New Madrid Power Plant shall operate continuous CO emission monitors to measure, record and report CO emissions compliance.
2. Continuous Emission Monitoring System (CEMS) – Unit 1 and Unit 2
 - A. New Madrid Power Plant shall install, certify, operate, calibrate, test and maintain CEMS for CO and any necessary auxiliary monitoring equipment in accordance with all applicable regulations. If there are conflicting regulatory requirements, the more stringent shall apply.
 - B. New Madrid Power Plant shall install and operate a data acquisition and handling system to calculate emissions in terms of the emission limitations specified in this permit.
3. Record Retention Requirements
New Madrid Power Plant shall maintain all records required by this permit, on-site, for the most recent 60 months of operation and shall make such records available immediately to any Missouri Department of Natural Resources' personnel upon request.

REVIEW OF APPLICATION FOR AUTHORITY TO CONSTRUCT AND OPERATE
SECTION (8) REVIEW

Project Number: 2006-06-026
Installation ID Number: 143-0004
Permit Number:

New Madrid Power Plant
St. Jude Road
Marston, MO 63866

Complete: June 5, 2006

Parent Company:
Associated Electric Cooperative, Inc.
P.O. Box 754
Springfield, MO 65801-0754

New Madrid County, S22N, T29, R14E

REVIEW SUMMARY

- New Madrid Power Plant has applied for authority to construct Over-Fire Air (OFA) combustion controls on Units 1 and 2 to reduce nitrogen oxide (NO_x) emissions.
- Hazardous Air Pollutant (HAP) emissions are not expected from the proposed equipment.
- None of the New Source Performance Standards (NSPS) apply to the proposed equipment.
- None of the National Emission Standards for Hazardous Air Pollutants (NESHAPs) or currently promulgated Maximum Achievable Control Technology (MACT) regulations apply to the proposed equipment.
- The Best Available Control Technology (BACT) requirements apply to the proposed equipment. Good combustion practices will control carbon monoxide (CO) emissions to a level of 0.55 lb/MMBTU on a 30-day rolling average.
- This review was conducted in accordance with Section (8) of Missouri State Rule 10 CSR 10-6.060, *Construction Permits Required*. Potential emissions of CO are above the major source threshold.
- This installation is located in New Madrid County, an attainment area for all criteria air pollutants.
- This installation is on the List of Named Installations [10 CSR 10-6.020(3)(B), Table 2, Number 26 – *Fossil-fuel fired steam electric plants of more than 250 million British thermal units per hour heat input*]. Therefore, the major source threshold for all criteria pollutants is 100 tons per year.

- Ambient air quality modeling was performed to determine the ambient impact of CO.
- Emissions testing is not required for the source.
- Revision to the Part 70 Operating Permit application is required for this installation within 1 year of equipment startup.
- Approval of this permit is recommended with special conditions.

INSTALLATION DESCRIPTION

New Madrid Power Plant includes two 615-megawatt (MW) gross (7,150 MMBTU/hr maximum heat input, based on 2001-2005 CEMs data) baseload coal-fired cyclone burner steam electric generating units – Unit 1 and Unit 2. The units utilize Powder River Basin (PRB) coal. Both units currently control particulate matter emissions using an electrostatic precipitator, while selective catalytic reduction (SCR) is utilized during ozone season (May through September) to control NO_x emissions.

The installation is a major source for both construction and operating permits. New Madrid Power Plant is considered a Part 70 source by operating permits and was issued Permit No. OP2001-003 in January 2001. The permit renewal (Project No. 2005-07-101) is currently under review.

The following construction permits have been issued to New Madrid Power Plant from the Air Pollution Control Program.

Table 1: Previously Issued Construction Permits

Permit Number	Description
1292-014	Switch from high sulfur to low sulfur coal
122002-013	Eight (8) 300 hp diesel-fired cooling water pumps
052006-001	Two (2) 345 horsepower (hp) diesel water pumps

PROJECT DESCRIPTION

New Madrid Power Plant proposes to install OFA combustion controls on both units in order to control NO_x emissions. NO_x reduction is achieved by limiting the amount of free oxygen that can combine with nitrogen by staging combustion from the cyclone boiler barrels. NO_x emissions are expected to decrease by at least 50% (around 0.66 lb/MMBTU), or by almost 15,000 tons per year. Collateral CO emissions are expected from utilizing OFA combustion controls. This generation takes place primarily in the lower furnace. Further combustion takes place while combustion air resides in the boiler, thereby reducing CO concentrations in the upper furnace. According to the applicant, in cyclone furnace applications, the concentration of CO in the upper furnace is unchanged or slightly higher than CO concentrations prior to OFA installation.

In determining Prevention of Significant Deterioration (PSD) applicability, a comparison

of future potential emissions was made with past actual emissions. The resultant difference exceeded the major source threshold, making the project subject to PSD review. Past actual emissions were calculated using the Environmental Protection Agency's Factor Information Retrieval (FIRE) Data System emission factor of 0.5 lb CO/ton coal. Since there has been no site-specific CO testing conducted, actual emissions could vary from this value. In fact, the past actual to future potential emissions could be less than the significance threshold. Electric utilities are allowed to use a less conservative past actual to future actual calculation methodology, but the applicant would then be required to track post-project emissions for a period of 5 years following the project. However, New Madrid Plant has decided to pursue the more conservative option of utilizing the past actual to future potential methodology, causing them to undergo PSD review.

Past OFA projects like this were considered pollution control projects (PCP) as defined in 40 CFR 52.21 (b)(32)(iii) because it is the installation of pollution control equipment to reduce emissions of one pollutant while increasing emissions of another pollutant, and were exempt from PSD permitting. The PCP exemption was based on a determination that the environmental benefit from an emission reduction outweighs the environmental detriment of any emission increases. Any collateral increase in emissions could not cause a violation of the applicable National Ambient Air Quality Standard. However, the Washington DC Circuit Court has vacated the PCP provisions. Now, any pollution control device that results in collateral emissions increase of a regulated pollutant must be permitted dependent on the magnitude of those collateral emissions.

EMISSIONS/CONTROLS EVALUATION

Collateral emissions of CO resulting from operation of the OFA combustion controls are the pollutant of concern. Potential emissions were determined based on an emission rate of 0.55 lb/MMBTU of CO from each of the boilers operating at 100% load. Heat input for each boiler was assumed to be 7,150 MMBTU/hr. Potential emissions of the application represent the potential of the new equipment, assuming continuous operation (8760 hours per year). Existing potential emissions were taken from Permit No. 052006-001. Existing actual emissions were taken from the applicant's 2005 Emissions Inventory Questionnaire (EIQ) submittal. The following table provides an emissions summary for this project.

Table 2: Emissions Summary (tons per year)

Pollutant	Regulatory <i>De Minimis</i> Levels	Existing Potential Emissions	Existing Actual Emissions (2005 EIQ)	Net Increase in Emissions
PM ₁₀	15.0	776	388	N/A
SO _x	40.0	23,357	13,701	N/A
NO _x	40.0	54,107	31,837	Decrease
VOC	40.0	278	230	N/A
CO	100.0	1,224	1,043	33,371
HAPs	10.0/25.0	151	143	N/A

*N/A = Not Applicable

PERMIT RULE APPLICABILITY

This review was conducted in accordance with Section (8) of Missouri State Rule 10 CSR 10-6.060, *Construction Permits Required*. Potential emissions of CO are above the major source threshold.

APPLICABLE REQUIREMENTS

New Madrid Power Plant shall comply with the following applicable requirements. The Missouri Air Conservation Laws and Regulations should be consulted for specific record keeping, monitoring, and reporting requirements. Compliance with these emission standards, based on information submitted in the application, has been verified at the time this application was approved. For a complete list of applicable requirements for your installation, please consult your operating permit.

GENERAL REQUIREMENTS

- *Submission of Emission Data, Emission Fees and Process Information*, 10 CSR 10-6.110
The emission fee is the amount established by the Missouri Air Conservation Commission annually under Missouri Air Law 643.079(1). Submission of an Emissions Inventory Questionnaire (EIQ) is required June 1 for the previous year's emissions.
- *Operating Permits*, 10 CSR 10-6.065
- *Restriction of Particulate Matter to the Ambient Air Beyond the Premises of Origin*, 10 CSR 10-6.170
- *Restriction of Emission of Visible Air Contaminants*, 10 CSR 10-6.220
- *Restriction of Emission of Odors*, 10 CSR 10-3.090

SPECIFIC REQUIREMENTS

- *Maximum Allowable Emissions of Particulate Matter From Fuel Burning Equipment Used for Indirect Heating*, 10 CSR 10-3.060
- *Restriction of Emission of Sulfur Compounds*, 10 CSR 10-6.260

BACT ANALYSIS

Introduction

Any source subject to Missouri State Rule 10 CSR 10-6.060, *Construction Permits Required*, Section (8) must conduct a BACT analysis on any pollutant emitted in greater than de minimis levels. The BACT requirement is detailed in Section 165(a)(4) of the Clean Air Act, at 40 CFR 52.21 and 10 CSR 10-0.60(8)(B).

A BACT analysis is done on a case by case basis and is performed in general by using a “top-down” method. The following steps detail the top-down approach:

1. Identify all potential control technologies – must be a comprehensive list, it may include technology employed outside the United States and must include the Lowest Achievable Emission Rate (LAER) determinations.
2. Eliminate technically infeasible options – must be well documented and must preclude the successful use of the control option.
3. Rank remaining control technologies – based on control effectiveness, expected emission rate, expected emission reduction, energy impacts, environmental impacts, and economic impacts.
4. Evaluate the most effective controls – based on a case-by-case consideration of energy, environmental, and economic impacts.
Select BACT.

Potential CO Control Technologies

CO emissions can be controlled by either minimizing CO formation during combustion or by post-combustion oxidation systems to oxidize any CO formed in the combustion process.

- Combustion Controls
 - ✧ Good Combustion Practices
- Post-Combustion Controls
 - ✧ Catalytic Oxidation
 - ✧ Thermal Oxidation

Good combustion practices prevent formation of CO during combustion. A number of measures can be taken to ensure that CO generation is minimized, including: maintaining proper fuel-to-air-flow ratios; visually monitoring combustion conditions for excessive haze, ash agglomeration and bridging on boiler tubes; periodically checking coal mill performance for coal fineness; periodically measuring unburned carbon to determine how combustion can be optimized; determining proper control settings for optimum efficiency and minimal CO generation; and empirically determining optimal CO emission rates and NO_x emission reduction during unit testing and tuning.

Catalytic oxidation requires oxygen, minimal heat and a catalyst to convert CO to CO₂. Catalytic oxidation is widely used in the refinery industry and for gas turbines in the utility industry. However, the noble metal catalysts typically used are highly susceptible to poisoning from high sulfur compounds. High particulate loading can also cause rapid deactivation and fouling. Placement of the oxidation unit downstream from the particulate matter control device would make re-heating of the exhaust stream necessary, increasing emissions of NO_x and PM₁₀ from combustion of additional fuel. The conditions necessary for CO conversion also favor the conversion of SO₂ → SO₃.

The applicant states that as great as 50% conversion could occur. The SO₃ would combine with moisture in the flue gas, increasing sulfuric acid mist emissions from the stack. Catalytic oxidation is not employed on large coal fired boilers due to the reasons cited, is not commercially available and is thus, considered technically infeasible.

Thermal oxidation also uses heat and oxygen for the CO → CO₂ conversion, but without the use of a catalyst. Temperatures in excess of 1,500° F are required. As with the catalytic oxidation unit, to prevent fouling, the thermal oxidizer would need to be located downstream of the particulate matter control device. Heat exchangers and a natural gas furnace would be needed to raise the temperature from approximately 292°F to the required temperature. Additional NO_x and PM₁₀ emissions would result. The same problems exist for thermal oxidation as for catalytic oxidation. There are no post-combustion controls in use on coal-fired boilers at this time; their use has historically been for the control of volatile organic compounds. Thermal oxidation is not considered to be technically feasible in this case.

BACT for CO

Good combustion practices are the only technically feasible alternative for minimizing CO emissions. A level of 0.55 lb/MMBTU heat input is chosen as the BACT limit (exclusive of start-up, shutdown and malfunction) on a 30-day rolling average. New Madrid Plant shall utilize CEMS to monitor the CO emissions from Units 1 and 2. In addition to the lb/MMBTU emissions limit, an annual CO emissions limit of 34,449 tons on a 12-month rolling basis will include start-up, shutdown and malfunction.

AMBIENT AIR QUALITY IMPACT ANALYSIS

An Ambient Air Quality Impact Analysis (AAQIA) must be completed for any air contaminant that exceeds the de minimis emission levels outlined in 10 CSR 10-6.020 (3)(A) Table 1. The AAQIA determines the ambient impact of emissions at or beyond the property boundary of the installation. New Madrid Power Plant conducted air dispersion modeling using the latest version of the SCREEN3 model (Version 96043). Additional impacts on visibility, growth, soils, plants and animals were also evaluated within the Class II area surrounding the facility.

PSD Increment is the maximum allowable increase in ambient concentrations of specific pollutants from all sources in a baseline area after the minor source baseline date. Only those pollutants and the associated averaging times that exceed the PSD significance level are reviewed for increment consumption. There is no increment level for CO and therefore, CO was not evaluated.

The screening analysis was conducted to determine if New Madrid Plant would be required to perform preconstruction monitoring, additional air quality modeling, or if the installation could forego further analysis altogether. If the preliminary analysis indicates that the facility will not significantly impact the air quality within a region, no further analysis is required. In addition to providing an indication of whether CO must undergo a full impact analysis, the results of the preliminary analysis determine what, if any, preconstruction monitoring will be required. If the preliminary analysis indicates that the

facility will not exceed the monitoring significance level, no preconstruction monitoring is necessary.

Since the emission rate is expected to increase at 70% load, those results were utilized in the analysis. Table 3 summarizes the results of the preliminary analysis. No further modeling or preconstruction monitoring is required for CO based on the results of the preliminary analysis.

Table 3: Significance Levels for Modeling and Preconstruction Monitoring ($\mu\text{g}/\text{m}^3$)

Pollutant	Averaging Period	Modeling Significance Level	Preliminary Analysis Results	Additional Modeling?	Pre-construction Monitoring Required?
CO	1-hour	2000	687.45	No	No
	8-hour	500	481.21		

Visibility

Visibility is a function of particulate and NO_x emissions. Since CO is the only pollutant that is increasing, no visibility impairment is expected. The reduction in NO_x will serve to improve the visibility impacts.

Growth

The building phase of the project is expected to temporarily increase the installation's workforce due to construction labor. The proposed modification will not require significant increases in the population.

Soils, Vegetation and Wildlife

Carbon monoxide is not known to injure plants. CO is not expected to have an adverse impact on threatened and endangered species.

STAFF RECOMMENDATION

On the basis of this review conducted in accordance with Section (8), Missouri State Rule 10 CSR 10-6.060, *Construction Permits Required*, I recommend this permit be granted with special conditions.

Lina Klein, P.E.
Environmental Engineer

Date

PERMIT DOCUMENTS

The following documents are incorporated by reference into this permit:

- The Application for Authority to Construct form, dated June 2, 2006, received June 5, 2006, designating Associated Electric Cooperative, Inc. as the owner and operator of the installation.
- U.S. EPA document AP-42, *Compilation of Air Pollutant Emission Factors*, Fifth Edition.
- Southeast Regional Office Site Survey, dated June 21, 2006.

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